

What is claimed is:

1. A sheet-like medium alignment apparatus comprising;
a means for aligning and loading a sheet-like medium ejected on a loading means with an ejecting means by pressing the end of said sheet-like medium on the upstream side in the direction of ejection by said ejecting means against the vertical wall (end fence) provided at the alignment position;

said sheet-like medium alignment apparatus further comprising a retaining means for ensuring that the already loaded sheet-like medium is not shifted to the downstream side in the direction of ejection by the sheet-like medium ejected on said loading means (tray);

wherein said retaining means moves between at least two positions - the first position as a waiting position separated from the sheet-like medium already loaded on the loading means and the second position for fulfilling said retaining function.

2. A sheet-like medium alignment apparatus according to Claim 1 characterized in that said retaining means is separated at said first position from the upper surface of the sheet-like medium loaded on said loading means, and is in contact with the sheet-like medium loaded on the loading means at said second position.

3. A sheet-like medium alignment apparatus according to Claim 1 characterized in that, before the end of said sheet-like medium ejected by said ejecting means on the downstream side in the direction of ejection contacts the sheet-like medium on the loading means, said retaining means moves from said position to the second position and fulfills said

retaining function and it then moves back to said first position.

4. A sheet-like medium alignment apparatus according to Claim 3 characterized in that, before the end of said sheet-like medium ejected by said ejecting means on the upstream side in the direction of ejection run onto the retaining means, said retaining means moves from the second position to the first position.

5. A sheet-like medium alignment apparatus according to Claim 3 characterized in that movement of said retaining means from the first position to the second position is triggered by the timing when the leading edge of the sheet-like medium on the downstream side in the direction of ejection has been detected by an ejection sensor provided at the closest position upstream from the ejecting means in said direction of ejection.

6. A sheet-like medium alignment apparatus according to Claim (3), said retaining means is located at the second position during the period of time after said retaining means moves to the second position before the leading edge of the ejected sheet-like medium contacts the sheet-like medium loaded on the loading means, until the leading edge of the ejected sheet-like medium does not move the sheet-like medium loaded on the loading means.

7. A sheet-like medium alignment apparatus according to Claim 6 characterized in that said period of time is variable according to the dimensions of the sheet-like medium.

has moved to the second position in an attempt to fulfill the retaining function.

13. A sheet-like medium alignment apparatus according to Claim 1 characterized by comprising said retaining means and a displacement means for allowing displacement between at least two positions.

14. A sheet-like medium alignment apparatus according to Claim 13 characterized in that said displacement means comprises;
a first member, a member shaped in a vertical orientation, with its intermediate position pivoted on a immovable member, wherein said first member is installed so as to allow rocking about the first pivot portion (said pivot portion) within a specified angle, and
a second member, a member shaped in a vertical orientation, with its intermediate position is pivoted on one free end side separated from the first pivot portion on the first member, wherein said second member is installed to allow rocking about the second pivot portion (this pivot portion) within a specified angle;
wherein a returning mean is pivoted on a desired free end off the rotational center on the second pivot portion of the second member, and a returning means is shifted to a different position in the direction of ejection by a combination between rocking of the first member and rocking of the second member.

15. A sheet-like medium alignment apparatus according to Claim 14 characterized in that the first member is rocked about the first pivot portion by the first rocking means installed on the free side opposite to

where the second member is mounted.

16. A sheet-like medium alignment apparatus according to (15) characterized in that the first rocking means comprises;
an eccentric cam rotating in contact with the free end of the first member and
a first contacting means for bringing said eccentric cam in contact with the free end side.

17. A sheet-like medium alignment apparatus according to Claim 16 characterized in that said eccentric cam is driven by a stepping motor and the amount of rotation is controlled by an encoder.

18. A sheet-like medium alignment apparatus according to claim 16 characterized in that the main component of the first contacting means is an elastic means installed between the first member and the immovable member.

19. A sheet-like medium alignment apparatus according to Claim 14 characterized in that the second member is rocked by a second rocking means installed to act on the free end side opposite to where the returning member is installed with the second pivot portion located in-between on the second member.

20. A sheet-like medium alignment apparatus according to Claim 19 characterized in that the second rocking means is a cam sliding along the free end on a desired side off the center of the second pivot portion on the

second member; and comprises a flat plate cam with protrusion formed on some portion and a second contacting means for allowing said free end to contact said flat plate cam.

21. A sheet-like medium alignment apparatus according to Claim 20 characterized in that a flat plate cam is located upward of the free end side of the second member.

22. A sheet-like medium alignment apparatus according to Claim 14 characterized in that the displacement means has a power transmission system for driving the returning means and said power transmission system mainly comprises pulleys rotating about the pivoting center of said first pivot portion and second pivot portion and belts applied to these pulleys.

23. A sheet-like medium alignment apparatus according to Claim 22 characterized in that rotation power is transmitted to said returning means by the pulleys provided concentrically with the first pivot portion and the second pivot portion and the belts between pulleys, and the rotation power is applied to the second member using the frictional force between the returning means and a pivoting shaft integral with the second member provided by the tension of these belts, whereby the function of the second contacting means is fulfilled.

24. A sheet-like medium alignment apparatus comprising a means for aligning and loading the sheet-like medium ejected on a loading means with an ejecting means by pressing the end of said sheet-like medium on

the upstream side in the direction of ejection by said ejecting means against the vertical wall (end fence) provided at the alignment position; said sheet-like medium alignment apparatus further comprising a returning means consisting of a rotary body wherein external force is applied to the sheet-like medium ejected onto said loading means (tray), and the medium is fed to said vertical wall so as to be aligned; wherein said returning means can be located at different positions in the direction of ejection.

25. A sheet-like medium alignment apparatus according to Claim 24 characterized in that the distance between one of said different positions and the other position is greater than the amount of variation in the position of the trailing edge of the sheet-like medium when falling on the loading means.

26. A sheet-like medium alignment apparatus according to Claim 25 characterized in that one of said positions is the first stop position upstream from the other position in the direction of ejection, without interference given to the loaded sheet-like medium ejected from the ejecting means, and the other position is the second stop position downstream from the first stop position in the direction of ejection, obtained by contact with the upper surface of the sheet-like medium on the loading means.

27. A sheet-like medium alignment apparatus according to Claim 26 characterized in that a third stop position is provided between the first stop position and the second stop position.

28. A sheet-like medium alignment apparatus according to Claim 24 characterized in that said returning means is provided, and a displacement means capable of reciprocating at least in said direction of ejection is also provided.

29. A sheet-like medium alignment apparatus according to Claim 28 characterized in that said displacement means comprises;

a first member, a member shaped in a vertical orientation, with its intermediate position pivoted on a immovable member, wherein said first member is installed so as to allow rocking about the first pivot portion (said pivot portion) within a specified angle, and

a second member, a member shaped in a vertical orientation, with its intermediate position is pivoted on one free end side separated from the first pivot portion on the first member, wherein said second member is installed to allow rocking about the second pivot portion (said pivot portion) within a specified angle;

wherein a returning mean is pivoted on a desired free end off the rotational center on the second pivot portion of the second member, and the returning means is shifted to a different position in the direction of ejection by a combination between rocking of the first member and rocking of the second member.

30. In a sheet-like medium alignment apparatus according to Claim 29 characterized in that the first member is rocked about the first pivot portion by the first rocking means installed on the free end side opposite to where the second member is installed.

31. A sheet-like medium alignment apparatus according to Claim 30 characterized in that the first rocking means comprises an eccentric cam rotating in contact with the free end side of the first member and a first rocking means for contacting the eccentric cam to the free end side.

32. A sheet-like medium alignment apparatus according to Claim 31 characterized in that the eccentric cam is driven by a stepping motor and the amount of rotation is controlled by an encoder.

33. A sheet-like medium alignment apparatus according to Claim 31 characterized in that the first contacting means mainly comprises an elastic means installed between the first member and immovable member.

34. In a sheet-like medium alignment apparatus according to Claim 29 characterized in that the second member is rocked by the second rocking means installed to act on the free end side opposite to where said returning member is installed with the second pivot portion located in-between on the second member.

35. A sheet-like medium alignment apparatus according to Claim 34 characterized in that the second rocking means is a cam sliding along the free end on a desired side off the center of the second pivot portion on the second member; and comprises a flat plate cam with protrusion formed on some portion and a second contacting means for allowing said free end to contact said flat plate cam.

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36. A sheet-like medium alignment apparatus according to Claim 35 characterized in that the flat plate cam is located upward of the free end side of the second member.

37. A sheet-like medium alignment apparatus according to Claim 29 characterized in that the displacement means has a power transmission system for driving the returning means and said power transmission system mainly comprises pulleys rotating about the pivoting center of said first pivot portion and second pivot portion and belts applied to these pulleys.

38. A sheet-like medium alignment apparatus according to Claim 37 characterized in that rotation power is transmitted to said returning means by the pulleys provided concentrically with the first pivot portion and the second pivot portion and the belts between pulleys; and the rotation power is applied to the second member using the frictional force between the returning means and a pivoting shaft integral with the second member provided by the tension of these belts, whereby the function of the second contacting means is fulfilled.

39. A sheet-like medium alignment apparatus according to Claim 24 characterized in that a controlling means is provided to ensure that retaining operation by the returning means is performed after the sheet-like medium has been ejected onto the loading means.

40. A sheet-like medium alignment apparatus according to Claim 39 characterized in that the operation of the returning means is triggered by

the timing when an ejection sensor installed in the most downstream portion in the transport system sensor has detected that there is no sheet-like medium.

41. A sheet-like medium alignment apparatus according to Claim 24 characterized in that the returning means is movable between the first stop position which does not interfere with the sheet-like medium loaded on the loading means and the second stop position which may interfere with the sheet-like medium loaded on the loading means, and a controlling means is provided to ensure that, subsequent to the movement of the returning means to the second position, movement is stopped for the specified time when the sheet-like medium returned by the returning means is pressed against the vertical wall; then the returning means is moved to the first position.

42. A sheet-like medium alignment apparatus according to Claim 41 characterized in that a controlling means is provided to ensure that the time when the returning means is stopped at the second position is variable according to any one of the quality, size and number of the sheet-like media ejected onto the loading means, or a combination thereof.

43. A sheet-like medium alignment apparatus according to Claim 41 characterized in that a controlling means is provided to ensure that the speed at which the returning means moves from the first position to the second position is slower than the returning speed of the sheet-like medium by the returning means.

44. A sheet-like medium alignment apparatus according to Claim 41 characterized in that a controlling means is provided to ensure that the returning means is moved to the first position when a jam has occurred in a sheet transport path upstream from the ejecting means.
45. A sheet-like medium alignment apparatus according to Claim 44 characterized in that a controlling means is provided to ensure that the returning means is disabled in the alignment operation immediately after a failure of the returning means has been detected.
46. A sheet-like medium alignment apparatus according to Claim 41 characterized in that, if the returning means consists of a returning roller, the drive speed when the returning roller is located at the first position is slower than the drive speed when it is located at the second position.
47. A sheet-like medium alignment apparatus according to Claim 46 characterized in that the return rotating speed of the returning roller at the second position is set to the value at which the sheet-like medium is not pushed out in the direction of ejection even if the trailing edge of the sheet-like medium contacts the returning roller.
48. A sheet-like medium alignment apparatus according to Claim 41 characterized in that the rotating speed of the returning roller at the first position is set to a constant value at all times, independently of the printing speed of the image forming apparatus to be connected.
49. A sheet-like medium alignment apparatus comprising;

- (1) an ejecting means for ejecting the transported sheet-like medium,
 - (2) a loading means (tray) for loading the sheet-like medium ejected by said ejecting means,
 - (3) an aligning means for ensure alignment by contact in such a way as to sandwich the end face parallel to the direction of ejection of the sheet-like medium by the ejecting means of the sheet-like medium loaded on said loading means (tray),
 - (4) a sorting means (tray feed means or adjusting member drive means) for sorting the sheet-like media by moving the loading means (tray) or aligning member by a specified distance in the direction at a right angle to the direction of ejection of the sheet-like medium by the ejecting means, and
 - (5) a returning means comprising a rotating body which achieves alignment by pressing the sheet-like medium against the vertical wall (end fence) provided at the alignment position;
- wherein the space (time) between sheets is reserved for the operation required for treatment by the sorting means, the returning means and aligning means, and the sheet-like medium ejection speed by the ejecting means can be controlled.

50. A sheet-like medium alignment apparatus according to Claim 49 characterized in that the ejection speed of sheet-like media (sheet-like media for which aligning operation and returning operation have been completed) is increased, in order to reserve the time required for the operation of the aligning means and returning means, until the sheet-like medium is loaded on the loading means, when the aligning means and the returning means operate.

51. A sheet-like medium alignment apparatus according to Claim 49 characterized in that, if there is a relationship of $T_s > T_1$ where T_s denotes the time required for the aligning operation by the aligning means and returning operation of the returning means, and T_1 represents the space between sheets (time) at a sheet receiving speed (V_1), then the ejection speed by the ejecting means, of the sheet-like media involved in said aligning operation and returning operation is increased over said V_1 , in order to satisfy the relationship of the space between sheets (time $T_4 : T_4 > T_s$).

52. A sheet-like medium alignment apparatus according to claim 49 characterized in that the sheet-like medium ejection speed is reduced in order to reserve the operation time of the sorting means until the first sheet-like medium subsequent to sorting is loaded on the loading means.

53. A sheet-like medium alignment apparatus according to Claim 49 characterized in that, if there is a relationship of $T_c > T_1$ where T_c denotes the time required for sorting by sorting means and T_1 indicates the space between sheets (time) at a sheet receiving speed of V_1 , only the ejection speed by the ejecting means of the first sheet-like medium transported during the sorting operation subsequent to sorting is lower than said V_1 in order to satisfy the relationship of the space between sheets (time $T_3 : T_3 > T_c$).

54. A sheet-like medium alignment apparatus according to Claim 53 characterized in that the first sheet-like medium ejected by said

operation is not aligned.

55. A sheet-like medium alignment apparatus according to Claim 49 characterized in that the ejection speed of the sheet-like medium by the ejecting means is readjusted to a moderate speed before the trailing edge of the sheet-like medium passes through the ejecting means, with consideration given to stacking properties.

56. An image forming apparatus comprising an image forming means for forming an image on the sheet-like medium and a transporting means for transporting said image formed sheet-like medium, said image forming apparatus further comprises a sheet-like medium alignment apparatus according any one of Claims 1 to 55.

57. A sheet-like medium treatment apparatus comprising a post-treatment means for post-treatment of sheet-like medium and a transporting means for transporting said post-treated sheet-like medium, said sheet-like medium treatment apparatus further comprising a sheet-like medium alignment apparatus according to any one of Claims 1 to 55.

58. A sheet-like medium treatment apparatus comprising (1) an ejecting means for ejecting transported sheet-like media, (2) a tray for loading these sheet-like media ejected by said ejecting means, and (3) a tray traveling means for performing sorting operation by traveling the tray a specified distance in the direction of shift orthogonal to the direction of sheet-like media ejected by the ejecting means in order to sort sheet-like media loaded on said tray; an aligning means for aligning sheet-like

media loaded on the tray is provided. Said aligning means has a pair of aligning members for ensuring that the aligned portions of the sheet-like medium ejected onto the loading means from the ejecting means are kept in contact with each other in such a way two end faces of the sheet-like medium in parallel with the direction of ejection are sandwiched, whereby said end face positions are aligned; and said sorting operation is performed in such a way that the sheet-like media loaded subsequent to sorting operation are aligned to a position different from that of the sheet-like media loaded before sorting operation.

59. A sheet-like medium treatment apparatus according to Claim 58 characterized in that the aligning means has an aligning member traveling means for traveling one of said pair of aligning members from the other or vice versa in the direction of separating them independently.

60. A sheet-like medium treatment apparatus according to Claim 58 characterized in that a concave is formed on the upper surface of said tray to ensure that part of said pair of aligning member can be positioned below the upper surface of said tray.

61. A sheet-like medium treatment apparatus according to Claim 60 characterized in that said concave is designed to have the dimensions which allow an aligning member to be accommodated when said aligning member aligns the minimum sized sheet-like medium.

62. A sheet-like medium treatment apparatus according to Claim 60 characterized in that the concave is designed to have the dimensions

which allow said pair of aligning members to be accommodated even when the tray has shifted in the direction of shift.

63. A sheet-like medium treatment apparatus according to Claim 60 characterized in that sheet-like media are ejected by the ejecting means when no sheet-like medium is loaded on the tray, if part of said pair of aligning members is located below the loaded surface of the tray.

64. A sheet-like medium treatment apparatus according to Claim 60 characterized in that aligning means comprises a supporting shaft for supporting the aligning member rotatably and a regulating member for regulating the amount of rotation about said supporting shaft of said pair of aligning members.

65. A sheet-like medium treatment apparatus according to Claim 64 characterized in that said pair of aligning members are rotated by the moment under their own weight, and are placed inside the concave on the upper surface of the tray or at the aligning position in contact with the top surface of the sheet-like media loaded on the tray.

66. A sheet-like medium treatment apparatus according to Claim 59 characterized in that said pair of aligning members can be placed by aligning member traveling means into at least two aligning positions;
(1) a receiving position where the aligning portions are located outside the end face of sheet-like media ejected from the ejecting means and which are separated from the end face, and
(2) an aligning portion where said aligned portions are located further

inside sheet-like media than said receiving position and are in contact with the end face.

67. A sheet-like medium treatment apparatus according to Claim 58, comprising a retracting means for retracting said pair of aligning members by rotating and moving them from an aligning position to a retract position, wherein said retract position is a position separated from the point where said pair of aligning members come in contact with the top surface of the sheet-like medium loaded onto the tray.

68. A sheet-like medium treatment apparatus according to Claim 67 characterized in that said pair of aligning members are moved to the retract position by the retracting means after completion of aligning a series of sheet-like media or before sorting the tray.

69. A sheet-like medium treatment apparatus according to Claim 68 characterized in that said pair of aligning members are displaced from the retract position to the alignment position by a retracting means, after said pair of aligning members have moved to said receiving position or the tray have moved in the direction of shift to perform sorting operation.

70. A sheet-like medium treatment apparatus according to Claim 58, comprising

- (1) an elevating means for elevating the tray, and
- (2) a positioning means for determining the position of the tray fed by the elevating means in the vertical direction in such a way that the vertical position of the upper surface of the tray or the sheet-like medium loaded

on the upper surface of the tray is the appropriate ejection position suitable for ejection of the sheet-like medium from ejecting means, when said sheet-like medium is ejected by said ejecting means.

71. A sheet-like medium treatment apparatus according to Claim 70 characterized in that the tray is lowered from the appropriate ejection position by an elevating means after a specified number of sheet-like media in an given job has been aligned or before the tray has been moved in the direction of shift to sort the sheet-like media in the next job.

72. A sheet-like medium treatment apparatus according to Claim 71 characterized in that the tray is moved upward to an appropriate ejection position by an elevating means after said pair of aligning members have moved to the receiving position or after the tray has been moved in the direction of shift in order to sort the sheet-like media in the next job.

73. A sheet-like medium treatment apparatus according to Claim 58 characterized in that said pair of aligning members consist of a plate body, the aligned portion is located at the bottom position of the aligning member, and the mutually opposite surfaces are formed of a flat surface orthogonal to the direction of shift.

74. A sheet-like medium treatment apparatus according to Claim 58 characterized in that said pair of members sheet escape portions wherein the upper portion of each aligned portion is formed in a space greater than the opposite spaces of these aligned portions in order that the sheet-like media ejected from the ejecting means are led within the opposite space of

these aligning members.

75. A sheet-like medium treatment apparatus according to Claim 58 characterized in that the inner edge of each lower end of said pair of members is formed in a sharp edge.

76. A sheet-like medium treatment apparatus according to Claim 58 characterized in that said pair of aligning members is made of the material wherein frictional coefficient of each lower end in contact with the sheet-like medium is smaller than the frictional coefficient between sheet-like media.

77. A sheet-like medium treatment apparatus according to Claim 58 characterized in that said pair of members are supported above the ejecting means by the apparatus proper.

78. A sheet-like medium treatment apparatus according to Claim 58 characterized in that the aligning means can be mounted or dismounted from the apparatus proper.

79. An aligning member drive apparatus comprising a pair of aligning members for aligning the position of the end faces through movement in the direction of alignment adjacent to the end faces so as to sandwich two end faces of the sheet-like media, said aligning member drive apparatus further comprising (1) a fulcrum shaft pivoted commonly to said pair of aligning members, (2) a push/move shaft for rotating the aligning member about the fulcrum shaft by coming in contact with each acting point on

each aligning member offset with respect to said fulcrum shaft, and (3) a rotation preventive member capable of preventing rotation due to angular moment about the fulcrum shaft under the weight of the aligning member, wherein said fulcrum shaft also serves as a guiding shaft for guiding each aligning member in the direction of alignment, and the rotation preventive member also serves as a drive means for moving the aligning member in the direction of alignment.

80. An aligning member drive apparatus according to Claim 79 characterized in that a switch/drive means is provided to ensure switching between the status of pushing and moving said acting point by acting on the push/move shaft and the status of releasing push/move operation.

81. An image forming apparatus comprising an image forming means for forming an image on the sheet-like medium and a transporting means for transporting, said image forming apparatus characterized by further comprising a sheet-like medium treatment apparatus according to any one of Claims 58 to 78.

82. A sheet-like medium treatment apparatus comprising a post-treatment means for post-treatment of sheet-like medium and a transporting means for transporting said post-treated sheet-like medium, said sheet-like medium treatment apparatus characterized by further comprising a sheet-like medium treatment apparatus according any one of Claims 58 to 78.

83. An image forming post-treatment apparatus comprising;

(1) an image forming apparatus comprising an image forming means for forming an image on the sheet-like medium and a transporting means for transporting said image-like sheet-like medium,

(2) a sheet-like medium post-treatment apparatus for post-treatment of sheet-like medium ejected from the image forming apparatus, and

(3) a transporting means for transporting said sheet-like medium post-treated by said sheet-like medium post-treatment apparatus;

said image forming post-treatment apparatus characterized by further comprising a sheet-like medium treatment apparatus according to any one of Claims 58 to 78.

84. A sorting and aligning method comprising a combination between (1) a step of aligning the sheet-like medium ejected on the tray by the ejecting means and (2) a step of sorting out sheet-like media by moving the tray in the direction of shift orthogonal to the direction of ejection;

said sorting and aligning method further characterized in that,

when the positions of two end faces of sheet-like media are aligned by the step of alignment by contacting the alignment portions of a pair of aligning members in such a way as to sandwich said two end faces of sheet-like media in parallel with the direction of ejection wherein sheet-like media are ejected from the ejecting means and loaded on the tray;

one of said pair of aligning members is fixed and the other is moved to align the end face of the sheet; thereafter, the tray is shifted in the direction of shift, and one of said pair of aligning members having been moved in said step is fixed this time, and its counterpart having been moved in said step is fixed, whereby sheets are aligned.

85. A sorting and aligning method according to Claim 84 characterized in that the step of aligning is realized when the aligning member located in contact with the already aligned sheet-like media subsequent to shifting of the tray is made immovable.

86. A sorting and aligning method according to Claim 84 characterized in that, if a stepping motor corresponding to each aligning member is used as a source for the step of alignment by said pair of aligning members, the stepping motor corresponding to the aligning member on the fixed side is driven by magnetic excitation alone without pulse sent thereto, and is used as a brake, whereby the fixed state is maintained.

87. A sorting and aligning method according to any one of descriptions in Claim 84 or according to Claim 29 characterized in that aligning operation is performed by moving a pair of aligning members when the size of a sheet-like medium is greater than the specified one.

88. A sorting and aligning method according to Claim 84 characterized in that said pair of aligning members are retracted upward and/or the tray is fed downward before the tray is shifted in the direction of shift.

89. A sorting and aligning method according to Claim 84 characterized in that the first sheet-like medium ejected from said ejecting means is not aligned by said pair of aligning members.